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PETROLOGICAL ABSTRACTS AND REVIEWS

ALBERT JOHANNSEN

ABENDANON, E. C. *Considérations sur la composition chimique et minéralogique des roches éruptives, leur classification et leur nomenclature.* La Haye, 1913. Pp. 34.

ANDERSEN, OLAF. "The System Anorthite-Forsterite-Silica," *Amer. Jour. Sci.*, XXXIX (1915), 407–54.

A description and discussion of experimental methods used, and results obtained, by fusing quartz, alumina, calcium carbonate, and magnesia. Solid phases of anorthite, forsterite, cristobalite, tridymite, clino-enstatite, and spinel were observed, and their thermal and optical properties determined. Anorthite and silica form a simple eutectic system, forsterite and silica form a system with an unstable compound, while anorthite and forsterite form no true binary system. The application of the results to igneous rocks is pointed out.

ARSCHINOW, W. W. *On Inclusions of Anthraxolite (Anthracite) in Igneous Rocks of Crimea.* Petrographical Institute "Lithogaea," Publication No. 4. Moscow, 1914. Pp. 15. (In Russian language.)

The term anthraxolite, originally proposed by Chapman for anthracite found associated with quartz and pyrite in certain veins in the Lake Superior region, is used by Arschinow for all bituminous substances. Such substances occur in the form of small, black inclusions in igneous rocks in two places on the southern shore of the Crimea. Since it also occurs as vein and cavity fillings in the rock, and in many cases is associated with calcite and quartz, it was probably formed, after the cooling of the magma, by the destructive distillation of bituminous substances disseminated in the stratified rocks.

BALL, SYDNEY H., and SHALER, MILLARD K. "Contribution a l'étude géologique de la partie centrale du Congo belge y compris la région du Kasai," *Ann. soc. géol. Belgique*, 1913, 199–247, map 1, pl. 3.

The writers found diabase, granite, diorite-gneiss, granitoid-gneiss, chlorite-schist, and amphibole-gneiss in this region.

BECK, KURT. "Petrographisch-geologische Untersuchung des Salzgebirges an der oberen Aller im Vergleich mit dem Stassfurter und Hannoverschen Lagerstättentypus," *Zeitschr. f. prakt. Geol.*, 1911, pp. 23, figs. 6, pl. 1.

Discusses the sequence of deposition and the characters of certain salt deposits, and compares them with the well-known deposits in Stassfurt and Hannover.

BECK, KURT. "Petrographisch-geologische Untersuchung des Salzgebirges im Werra-Fulda-Gebiet der deutschen Kalisalzlagerstätten," *Zeitschr. f. prakt. Geol.*, XX (1912), 133–58, figs. 12, pls. 2.

Discusses the stratigraphical and structural relationships of the salt deposits of Werra and Fulda.

BEGER, P. J. "Zinnerzpneumatolyse und verwandte Erscheinungen im Kontakthofe des Lausitzer Granits," *Neues Jahrb. Min., Geol., und Pal.*, 1914 (II), 145–82, figs. 4, pls. 2.

The writer discusses the contact zone of the Lausitz granite, describes various pegmatites, greisens, etc., and concludes that the chlorite in the highly metamorphosed greywacke is a pneumatolytic mineral due to the adjacent granite.

BENSON, W. N. "The Geology and Petrology of the Great Serpentine Belt of New South Wales" (in five parts), *Proc. Linnean Soc. New South Wales*, XXXVIII (1913), 490–517, 569–96, 662–724; XL (1915), 121–73, 540–624; maps 6, figs. 29, pls. 10.

The region described in these papers passes north and south through Tamworth, and lies between Sydney and Brisbane, about 280 miles from the former. Through the center of the region extends a north-and-south fault, separating it into two portions. Along this fault is a series of intrusions of rocks now serpentine, not continuous but forming separate patches from 100 yards to 30 miles in length and from a few inches to nearly two miles in width. The formations indicate that after a long period of sedimentation heavy orogenic pressure came from the east, folding and metamorphosing the eastern series, but having less effect on the western. The pressure caused the formation of an overthrust fault which became the channel for the ascent of certain basic rocks. The sedimentary formations, which prior to the folding had a thickness of over 30,000 feet, are described, and a list is given of the fossils found.

The igneous history begins in Lower Devonian times with the extrusion of spilitic lavas and tuffs. In the Middle Devonian similar rocks attain a thickness of over 7,000 feet, and associated with them are 2,000 to 3,000 feet of intrusive dolerite, in many cases albitized. In Upper Devonian times some 3,000 feet of agglomerates were formed, and, after a long period of quiet, rhyolites, andesites, and tuffs appeared in the Lower Carboniferous. The intrusion of the peridotites then followed, chiefly along the fault line previously mentioned, and probably during the crust-movement at the close of the Carboniferous. Gabbros and eucrites came later than the serpentine, and cutting these are dikes of dolerite. From latest Carboniferous to early Mesozoic times came a long series of granitic intrusions consisting of granodiorites and porphyries, and titanite-, tourmaline-, and other granites. Besides these rocks there are numerous lamprophyres whose time period was not determined. Following the Permo-Carboniferous was an era of great crumpling, then followed a long period of erosion which exposed the granite, and then a later period of sedimentation. During Tertiary times the formations were largely volcanic, and thick flows of basalt occurred. A great period of elevation and block-faulting closed the Tertiary.

The second paper deals with the geology of the Nundle District, and the third with the petrology of the entire region. Various rocks are described: spilites, used in the sense of Dewey and Flett for lavas with sodic feldspars, contain acid oligoclase and augite with some secondary chlorite and epidote and with or without magnetite; the so-called "keratophyres" are composed almost entirely of acid oligoclase with some interstitial chlorite from augite; the dolerites consist of plagioclase (andesine to albite), augite, magnetite, with a little quartz and various accessories, and are medium-grained. The term dolerite is apparently used in a different sense from that common in the United States, where it signifies a coarse-grained basalt containing a basic plagioclase. The writer speaks of albitization proceeding inward in the feldspars, by which he means, apparently, that the sodic rims are secondary. It would seem more probable that the zonal rims are primary. The rock thus appears to be an augite-andesite. The peridotites are chiefly harzburgites, but there are local occurrences of dunite and lherzolite. With the absence of olivine, enstatolites occur. Associated with the peridotites and pyroxenites are rarely amphibolites and olivine-gabbros, more commonly eucrites and anorthosites. The silicic rocks described are felsites, granodiorites, and various granites. Malchites, granite-porphyries and quartz-porphyries, and minettes, vogesites, and camptonites occur as dikes.

Twenty-two analyses are given of rocks of this region, unfortunately showing a number of typographical errors and errors in proof-reading owing to the absence of the author from the state during the passage of the paper through the press.

The fourth paper deals with the dolerites, spilites, and keratophyres of the Nundle District. In this the statement is made that the feldspar of the keratophyre is pure albite and not acid oligoclase, as stated in the earlier paper. The spilites, dolerites, and keratophyres all appear to be intrusives in the sediments. Certain of the spilites, in the opinion of the author, were intruded into soft mud, for they show a pillow structure. Most of the rocks are rich in primary albite.

The fifth paper is on the geology of the Tamworth District. A series of radiolarian claystones was deposited at shallow depths on a steadily sinking sea-floor in Devonian times. There were two periods of volcanic activity, and masses of tuffs and agglomerates accumulated in the sea, and spilites, dolerites, and keratophyres were intruded. The total thickness of the series is unknown, but apparently about 12,000 feet are Middle and Upper Devonian. Faulting and folding took place in the Carboniferous period, followed by peridotitic intrusions, and later by intrusions of granite. A final eruption of basalt occurred in the Tertiary period.

BERKEY, CHARLES P. "Petrographic Range of Road-Building Materials," *School of Mines Quart.*, XXXV (1913), No. 1, pp. 6.

BLANCHARD, RALPH C. *The Geology of the Western Buckskin Mountains.* Dissertation. Columbia Univ., 1913. Pp. 80, numerous figs.

BOEKE, H. E. "Bemerkung über die Theorie von J. Johnston bezüglich des Verhaltens fester Stoffe unter ungleichförmigem Druck," *Centralbl. f. Min., Geol., u. Pal.*, 1913, 321–24.

BOEKE, H. E. "Die Methoden zur Untersuchung des molekular Zustandes von Silikatschmelzen," *Neues Jahrb. Min., Geol., u. Pal., B.B.*, XXXIX (1914), 64–78.

BOEKE, H. E. *Grundlagen der physikalisch-chemischen Petrographie.* Gebrüder Borntraeger, Berlin, 1915. Pp. xii+428, figs. 168, pls. 2.

In view of the important bearing of recent physico-chemical research upon the problems of the origin of igneous rocks, this work is most timely and acceptable, and is to be recommended to all advanced students of petrology. It is an invaluable summary of work already done, and contains many suggestions for future work.

The author not only presents the results of previous work but describes in detail the methods and apparatus by which these results were obtained. The subject is presented in a very clear and orderly manner, and as simply as is compatible with the nature of the subject. In his treatment the author follows the inductive or synthetic method, that is, he describes first the behavior of the simplest constituents of rocks under known conditions of composition, temperature, pressure, time, etc., and compares the results with those found in nature. Beginning with the magma, he traces it through all stages of cooling and through the gradual changes which take place in its solidification products.

In older petrologic textbooks there is a great variety of views as to observed phenomena, primarily because so many factors must be taken into consideration, and one or another may predominate. Since in many cases there are more unknown than known factors, a single solution may be impossible. The synthetic method seeks to determine, by exact and systematic investigation, the action of each factor, such as temperature, pressure, capillarity, etc.

In most provinces of petrology only the beginning of inductive research has been made, and the experimental work so far is no more than a groping after the truth. Little can be said at the present time as to the formation of rocks from their complicated magmas, and physical chemistry can not yet settle such questions as the origin of magmatic differentiation, the relation between the alkali and alkali-lime rocks, and that of dike satellites to parent rock, etc., on account of the lack of reliable data.

The present text is so comprehensive that only the very briefest outline of the contents of the various chapters can be given; a list of the subheads alone would require five or six pages of this Journal. After a short discussion of homogeneous and heterogeneous equilibria, the subject of magmatic rock-formation is taken up. Under this head the author treats of the essential components of magmas and the melting-points of minerals, and includes a discussion of various methods of determining melting-points and of obtaining and measuring high temperatures in the laboratory. He speaks of the alteration of melting-points at different pressures, of uniform and non-uniform pressures, and of overheating and undercooling. Under the properties of silicate melts are included internal friction and diffusion, surface-tension, electrical conductivity, influence of gravity and centrifugal force upon the composition of melts, measurements of density at high temperatures, etc. Following a chapter on the inversion points of minerals, he discusses the genetic significance of melting- and inversion-points in rock-forming minerals. He describes two, three, four, etc., point systems, and then devotes about seventy-five pages to the physico-chemical, especially the thermal, properties of the more important rock-forming minerals.

In the second division of the book the author takes up the gases in magmas—their nature, their solubility in melts, and their equilibrium. In the third division he treats of the pegmatitic, pyrohydatogenic, and hydrothermal phases of the solidification of magmas. Here are included the properties of water at high temperatures, and a general discussion of the formation of minerals in systems with volatile components. Then follows a chapter on the synthesis of pneumatolitic and hydatogenic minerals; then hydrothermal synthesis, solubility of the common products of hydrothermal mineral-formations, alteration with temperature and pressure of salts which are but slightly soluble, the relationship of solubility and size of grain, succession and paragenesis of the hydrothermal ores and vein-minerals, zeolites, etc.

The fourth division is devoted to weathering or colloid mineralogy; the fifth to sediments. Here is included a long discussion of salt deposits (43 pp.) to which the author has devoted considerable study. The book closes with a short chapter on metamorphism and a double column index of 26 pages.